

EXPERIMENT OF MR. ERNEST A. MEACHAM, RIVERSIDE, CAL.

"On the morning of February 9, 1900, at the Meacham Ranch, a test was made of the Meacham warm water method of protecting citrus fruits against frost. The experiment began at 3:45 a. m. and was conducted in the presence of a number of gentlemen belonging to the Riverside Horticultural Club, nearly all of whom were orange growers.

"At 6:30 a. m. the temperature of the ground 100 feet or more away from the boiler was 32°. The temperatures given herewith are those obtained by Mr. McAdie of the Weather Bureau with sling psychrometer No. 70; the number of the dry thermometer was 4487 and of the wet 4486. The plant consists of a 12-horsepower tubular horizontal boiler, laid in a brick furnace and arranged to deliver water with or without pressure. Cold water enters the bottom of the boiler and is delivered from the top orifice directly into the flume. The fuel used was crude petroleum, of which about 50 gallons were used in three and one-half hours. At the rate of 14 gallons an hour and an estimated cost of a little over 4 cents per gallon, the actual expense of fuel for the experiment was about 60 cents per hour. The oil is burned with a steam jet under pressure. A secondary 6-horsepower boiler, carrying 70 pounds of steam, was used. The oil is thus entirely consumed and makes but little smoke. The whole arrangement is such that not more than two men would be required to attend to all the details.

"Fifty minutes from the time of beginning, the water which had an initial temperature of 55.4° was raised 30°. Two sets of temperature records were made, one by Mr. Priestley Hall and the other by Mr. McAdie. In Mr. Hall's test 8 inches of water was run in 50 furrows, which barely ran the water past the ends of the furrows. In the second case 8 miners' inches of water was delivered into 25 furrows, thus carrying the heat farther down the furrows than in the first experiment. According to the present laws of California, a miners' inch is $\frac{1}{16}$ cubic foot per second; the "second-foot" is the quantity represented by a stream 1 foot wide and 1 foot deep, flowing at the average rate of 1 foot per second. A cubic foot of water, maximum density, weighs 62.4 pounds; a gallon contains 10 pounds of distilled water at 62°. The data obtained by Mr. Hall were as follows: 5:30 a. m., normal temperature, 34°; normal temperature of water, 60°; temperature of heated water, 92°; at the flume, 92°; 20 rods from the flume, 58°; 40 rods, 52°; temperature of unheated water 40 rods from the flume, 41.5°; vapor condensed on trees early in the morning and more condensed on the trees in the heated plat.

"Mr. McAdie's records are as follows: Time, 6:30 a. m., air temperature varying from 34° to 36°; temperature on the ground, 32°; frost was observed on grass blades; initial temperature of water, 55.4; heated

water delivered to flume at 85.2; in a straight line down a furrow 200 feet from the boiler in the direction of the wind (motion of the air was very gentle) there was a fall in temperature of 14.2°; water vapor was observed rising to a height of about 4 feet; 200 feet from flume, as stated, the temperature of the water was 71°; the temperature of the surface soil 4 inches right and left of the water was 43°; temperature of the soil 16 inches from the water or in the middle of the ridge, 42.2°. It is presumed that the temperature of the ground, had no water been flowing, would have been 33°, and it would seem as if the soil itself was warmer by nearly 10°. At the end of a furrow, 600 feet, the temperature of the water was 54°, or there had been a fall of 31° in 40 rods; the temperature of the ground 4 inches from the water, 38°; 16 inches from the water, 36°; temperature of unheated water 50 rods from the flume, 40°.

"The approximate value of the plant was \$200, and it is estimated that for a plant all equipped sufficient for a 10-acre grove \$600 would cover all expenses. See fig. 7, Plate IV."

SPRAYING.

After frost, or rather just before a frost has ended, a spraying device can be used to advantage. Its chief function is to prevent a too rapid warming of the chilled fruit. It is said by horticulturists that even the light coating of ice formed in this way does not seriously damage the fruit. It is very likely that the latent heat of solidification set free by the change from water to ice may play a helpful part; but the chief effect is to prevent a too rapid thawing. In other words, both heat and water should be supplied to the chilled plant slowly, and according to the plant's ability to make good use of the same. At the A. J. Everest Ranch at Riverside, Cal., a portion of the grove is protected by sprinklers at the top of fifty-foot masts.

PROTECTIVE METHODS BASED UPON SCREENING OR COVERING.

All screening or covering devices are in effect modified hothouses, and there is no question but that a thorough protection can be accomplished. The expense is the one objection. Screens are made of light materials, namely, canvas, muslin, or light wood work, and have been used with considerable success. At the A. J. Everest Ranch an elaborate structure of lath screens is in use, illustrations of which are given herewith (see figs. 8 and 9, Plates IV and V). There is no question as to the value of the protection, but the expense is considerable, averaging perhaps \$400 to the acre. This lath covering may be considered as forming a well ventilated hothouse.

NOTES BY THE EDITOR.

MR. HOWARD SHRIVER.

Mr. Howard Shriver, the well-known meteorological observer, was born at Sandy Mount, near Baltimore, Md., November 8, 1824, and died February 5, 1901, in Cumberland, Md., where he had spent most of his life, and of which city his father, Thomas Shriver, was formerly mayor. His interest in weather observations began at an early period. He began observations while living in Virginia in 1866, and the Editor well remembers his visit to the Central Office in Washington in 1873. He had a genuine love for the study of natural science and took the greatest pleasure in communicating his results to others. He was particularly interested in the study of the climate and flora of the neighborhood of Cumberland. His elder brother, Edwin Thomas Shriver, had begun a meteorological record in January, 1859, and the combined record of the two brothers, therefore, extends forty-two years, or to January, 1901. A summary of the principal results of these observations is published in the report on the geology of Allegheny County recently issued by the Maryland Geological Survey. Mr. Shriver's instrumental equipment was unusually complete for a voluntary observer. He was one of the best known citizens of Cumberland, a favorite with the children and the school officials, and a great gathering attended the commemorative public exercises held on February 24 in the Academy of Music. A fuller account of Mr. Shriver's work is given in Dr. Fassig's notice, published in the February report of the Maryland and Delaware Climate and Crop Section.

DR. EARL FLINT.

Dr. Earl Flint, M. D., for many years voluntary observer of the Weather Bureau at Rivas, Nicaragua, died January 21, 1901. He will be remembered by students of Central American climatology as the one meteorological reporter in all that great region, stretching from Mexico on the north to the Isthmus of Panama on the south, who made a continuous record of the weather for upward of twenty years. Dr. Flint's meteorological work began in 1881 and continued without interruption until his last illness.

Dr. Flint was a student of archaeology and ethnology as well as of meteorology. Before locating in Rivas he had traveled extensively, not only in Mexico and Central America, but throughout the more northern countries of South America. During his travels he found opportunity to make a number of interesting and important archaeological collections, some of which were later in his life deposited in the National Museum in Washington, D. C. He was always a student of material things, an intelligent observer, a zealous collector, and an honored citizen of his adopted country.—A. J. Henry.

HERBERTSON'S DISTRIBUTION OF RAINFALL OVER THE LAND.

In the important and elegant Atlas of Meteorology edited by Buchan and Bartholomew and recently published by Archibald, Constable & Company, of London, there are re-